# Growing the Jerusalem Artichoke

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# GROWING THE JERUSALEM ARTICHOKE

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## Introduction

For the past 10 or 12 years there has been a growing but more or less sporadic interest in the Jerusalem artichoke (*Helianthus tuberosus* L.) as a possible source of raw material for the manufacture of certain plant products. It has long been grown to a very limited extent in gardens widely distributed over the country; in a few areas, particularly the Northwest and Pacific Northwest, it has been grown on a field scale as a stock feed and forage plant. For the last-named purpose it is grown extensively in France and certain other European countries, but despite many claims made for it, it has not become a crop of major importance in the United States, to which it is native.

It is not the purpose of this leaflet either to discuss or to predict the probable future importance and usefulness of the Jerusalem artichoke in agriculture or in industry. The purpose is to present a brief summary of the present knowledge of the behavior of the crop in various parts of the country, of varieties, methods of culture, limitations, and difficulties that may be encountered in growing and handling Jerusalem artichokes. The plant has not been exhaustively studied under American conditions, and its habits are not generally well understood. Many erroneous and misleading statements have been made about it by persons who either lacked knowledge of the crop or sought to exploit it at the expense of those unfamiliar with it. If the Jerusalem artichoke is ever to attain an important status in American agriculture, it can only be through a careful consideration of as many facts as can be learned about it. Unrestrained enthusiasm and unwarranted claims for a new crop are certain to cause loss to many persons and may also serve to delay the development of enterprises of some value.

## Adaptability to Climate

Although the Jerusalem artichoke will live practically anywhere in the United States that other crop plants are grown, it appears to be better adapted to the northern two-thirds of the country than to the southern third. Observations of investigators in southern Louisiana and southwestern Texas, for example, indicate that it is very difficult to maintain planting stock and to obtain good stands, and that yields are not very encouraging. Although some growers

[1] The information given in this leaflet is based largely on investigations carried on in cooperation with the State agricultural experiment stations of Illinois, Minnesota, and Oregon, reported in U. S. Department of Agriculture Technical Bulletin 514.

have had a measure of success in the South, there is little to indicate that it is well adapted to the lower South. It should be tried only with caution in the Gulf region and in the arid Southwest.

Some persons erroneously believe that the crop will give high yields with a very meager water supply. The Jerusalem artichoke cannot be recommended as a dry-land crop, for it has been observed under experimental conditions to suffer just as severely from drought as certain other farm crops commonly grown in the East and Middle West. In irrigated areas it requires heavy applications of water. Although the plants may survive periods of drought and recover to make a small yield, water shortage very seriously prevents normal growth and tuber development. Its planting is not recommended in regions where the normal annual supply and distribution of water are inadequate for corn.

Limited tests at high altitude in the Great Plains region have shown the artichoke to be unsatisfactory there, even though the soil was fertile and irrigation water was available. The plants are killed by the first freeze in the fall, and the crop is of doubtful value in regions having a growing season of 125 days or less.

## Varieties

Although innumerable forms, stocks, and strains of the Jerusalem artichoke are in existence, well-defined and described varieties are practically unknown to growers. Mammoth French White, French White Improved, and other variations of supposedly the same name are most frequently mentioned by growers and writers. These names, as used at present, however, refer only to a general type rather than to a specific, well-defined, and recognizable variety. The United States Department of Agriculture and cooperating State agricultural experiment stations have had several such named strains under comparative test and have found very marked differences among them, particularly in yield.

Cooperative studies by these agencies have shown that in general a given variety has a wide range of adaptability. Those varieties that ranked high in the East were also high in the Middle West, North, and Pacific Northwest. Conversely, sorts that ranked low in one place were generally poor elsewhere. Under different exacting conditions of climate, it is probable, however, that so-called varieties can be found that will be better adapted in one place than others because of earliness and resistance to heat, to disease, or to some other limiting factor.

Small quantities of planting stock can be obtained from any of a large number of commercial seedsmen, among them being many who issue catalogs and conduct mail-order businesses. Most of these dealers do not and cannot identify by any varietal name the stock they offer. So far there has been little demand for specific varieties. The stocks obtained from different sources will be found to differ widely with reference to plant habit, tuber shape, tuber color, and yield. Some may be found to be very desirable, while others will be less so. There is no well-established trade in planting stock, so that buying an unknown stock is often somewhat of an unavoidable gamble.

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The Department of Agriculture and a number of the State agricultural experiment stations are maintaining small lots of certain apparently superior kinds of Jerusalem artichoke for their experimental use, but as yet there has not been sufficient commercial demand to justify seedsmen or others in developing large supplies of these sorts for general sale.

## Soils and Fertilizers

Another erroneous impression that has become general is that the Jerusalem artichoke is a "poor-land crop"—that it does well on worn-out or marginal lands. This is distinctly untrue. It is a large, vigorously growing plant that needs an abundance of available plant nutrients and water if it is to make good yields. It accordingly yields markedly more on rich soils than on soils that are poor. It also requires a soil that is well drained. The crop is best adapted to rich sandy loams, to rich light loams, and to well-drained river-bottom or alluvial soils. Soils well suited for potatoes or corn are well suited for artichokes, except that artichokes should not be grown on distinctly heavy soils. The tubers average much smaller than potato tubers, are more numerous per hill, and can be harvested from heavy soils only with great difficulty and expense.

Very few experiments have been conducted in this country to determine the fertilizer needs of the Jerusalem artichoke when grown upon various soils. Studies at the New Jersey Agricultural Experiment Station on a sandy loam soil showed that 500 pounds of complete fertilizer analyzing 6 to 8 percent nitrogen, 8 percent phosphoric acid, and 4 to 6 percent potash were the most effective of a wide range of mixtures tested. Upon general considerations and in the absence of more detailed information for other areas, 500 to 750 pounds of a complete fertilizer, a 4–8–4, a 4–12–4, or closely similar mixture, is generally recommended.

Despite the fact that the heavier and more fertile soils generally yield much more than the sandy and sandy loam soils, Jerusalem artichokes on the latter types did not yield significantly more in the New Jersey tests with 1,000 to 1,500 pounds of fertilizer than with 500 pounds. It remains to be determined how much fertilizer can profitably be used, in general. If industrial uses for the crop are developed, it is a foregone conclusion that high acre yields must be produced at a low cost per ton. Under such requirements, in order to be profitable, the crop would probably be confined chiefly to the more fertile soils that would give good yields without great expenditures for fertilizers.

## Planting

Repeated cooperative experiments in several locations have made possible some rather definite conclusions and recommendations concerning time of planting, size of seed piece, depth of planting, and distances between hills and rows.

### Time of Planting

Tubers should be planted just as early as possible in the spring, as soon as the soil can be satisfactorily worked, regardless of loca-

tion. There is apparently no danger of planting so early as to affect yield adversely. Late planting usually reduces the yields and the size of tubers seriously.

### Size of Seed Piece

Whole tubers or tuber pieces about 2 ounces in size should be planted. Although the plant can be propagated from much smaller seed pieces or tubers, from one-half ounce or even smaller pieces, the use of small pieces results in lower yields. There is no evidence that seed pieces weighing more than 2 ounces are superior to 2-ounce pieces.

### Depth of Planting

The tubers should be planted like potatoes and covered to a depth of 4 inches. Deeper planting, under most conditions, may result in delayed emergence and a weakened condition of the sprouts. Planting deeper or shallower than 4 inches has given slightly lower yields under experimental conditions. If planted deeper the tubers develop more deeply in the soil and are harder to harvest.

### Planting Distances

Except under conditions known to be unusually favorable for the crop, as in western Oregon, the seed pieces should be planted 2 feet apart in the rows, with the rows 3 to 3½ feet apart. These distances usually give the maximum acre yields without depressing the average tuber size by crowding.

These planting distances do not give the maximum yields per hill. Average yields per hill may be much greater at wider spacings, up to about 4 feet apart, in rows 5 to 6 feet apart. If it is desired to obtain the largest possible increase of a limited amount of planting stock, regardless of yield per unit of land area, the wider spacings should be used.

In certain especially favorable regions the Jerusalem artichoke makes such an enormous growth that equally large yields are produced at wide spacings of 4 feet in rows that are 4, 5, or 6 feet apart. The closer spacings merely result in crowding and give no greater acre yields than the wider spacings.

## Cultivation

Cultivation should be shallow, not more than 1½ to 2 inches deep, to avoid damaging the stolons and tubers. Tubers begin forming in August. The crop should be cultivated and hoed only sufficiently to control the weeds thoroughly. Little, if any, cultivation will be required after stolon formation is well under way, since by that time the plants should practically meet between the rows and shade out the weeds.

## Harvesting of Tops

It has frequently been stated or implied that one of the remarkable features of the Jerusalem artichoke is its capacity to produce a large yield of tubers and also a large yield of succulent forage at the same time. The plant does not do both. Either a crop of forage or a crop of tubers can be harvested from a planting, but not both.

It is important to know that the maximum yield of green tops is available at or just before the time the plants blossom. After this, the yield of green tops and also the yield of dry matter declines rather rapidly as a result of dropping of leaves and, possibly, the heavy movement of food materials from the tops into the tubers. The tops also increase in fiber and coarseness after blossoming, making the product less desirable for forage.

Although the tubers start to form in early August, they develop rather slowly up to the time of blossoming, when the maximum green weight of forage is available in the tops. If the tops are harvested at this stage the tuber yield will be but one-fourth to one-third what it would be if the tops were left undisturbed until frost. If the tops are removed soon after blossoming, when they will yield the maximum amount of dry matter, the yield of tubers will be but 40 to 60 percent of the normal yield. Even the very latest top harvest that is likely to produce forage of only medium quality and yield reduces tuber yield by about 30 percent.

If the tops are left undisturbed until frost, to obtain the maximum yield of tubers, they are of little or no value for forage. The first freeze blackens the leaves, and they soon dry out and shatter from the branches.

## Harvesting of Tubers

Before the tubers can be dug from the soil it is necessary to cut and remove the large woody tops from the rows. At present the problem of efficient harvesting on a commercial scale at low cost remains to be solved. The tuber characters and the distribution of the tubers of most varieties in the soil are such that the conventional potato-harvesting machinery is inadequate. Special machinery adapted to the wide distribution, the generally small size, and the delicate structure of the tubers is not yet available, no doubt because there has been insufficient demand to justify its development and production. Turning out the tubers with a plow or a middlebuster leaves a relatively large proportion of the tubers in the soil and also requires much scratching out by hand. Hand digging with forks probably yields the largest percentage of the tubers present in the soil but is extremely laborious and expensive. The average size of most tubers is relatively small, so that picking up proceeds rather slowly.

## Storage and Handling

The Jerusalem artichoke tuber has no heavy corky layer or skin as has the potato tuber, but only a very thin skin, which is very easily injured. The skin is so thin that the moisture in the tuber is very readily lost, causing the tuber to shrivel seriously upon exposure to the air. After being dug, the tubers are difficult to store for more than a very few weeks without heavy loss from shrinkage and sometimes from decay. At the same time, however, they usually keep perfectly if left undisturbed in the soil until they are needed for use. Even the freezing of the soil does no damage. Obviously, they cannot be harvested from frozen soil, but tubers for spring planting are best left in place where they grew, until spring. They should then be harvested and handled promptly, before they sprout appreciably.

Tubers should not be left in poorly drained soil.

Good, sound, disease-free tubers can be successfully kept several months in cold storage at a high humidity and a temperature of 32° F.

## Eradication of Volunteer Growth

It is so nearly impossible to harvest the tubers completely that a field in Jerusalem artichokes 1 year will produce a large number of volunteer plants the following spring. The tubers have a remarkable capacity for resprouting and surviving rough treatment in the spring, and so tend to become a weed. It is important that all volunteer plants be completely destroyed before they set tubers in August, for these will survive into the second season, further increasing the number of undesired volunteer plants.

The best method of eradicating volunteer growth is to follow artichokes with a late-sown, quick-growing hay crop or cultivated crop. The land should be deeply and thoroughly plowed in the late spring when the volunteer plants are a foot or more high. (Early plowing, when they are small, will only result in the emergence of another crop of sprouts.) The few that survive should be hand-pulled unless they will be completely destroyed before August in the harvesting of the crop in which they are growing.

## Yield of Tubers

It is a common error for enthusiastic advocates of any type of enterprise to characterize its possibilities on the basis of certain unusually good results that have been obtained experimentally or under unusually favorable conditions. There is likewise a tendency to overestimate the average yields of Jerusalem artichokes that can reasonably be expected under ordinary farm conditions.

Acre yields of 15 to 16 tons or more, obtained under very favorable conditions, are not typical even of experimental plots, where every precaution is taken to insure good crops and to harvest the tubers completely. On reviewing a large group of experimental results, it was found that the average yields over three seasons for several locations were but 8 to 10 tons an acre. It is well known that in general farm practice the yields of any crop average just about half to two-thirds of the yields generally recorded in carefully controlled experiments under favorable conditions.

With these considerations in mind, and recalling the difficulties of harvesting most of the varieties of Jerusalem artichoke, it seems likely that the average acre yield for the next few years, at least, will not be far from 5 to 6 tons. This estimate applies to commercial acreages grown under ordinary farm conditions in the East, South, and Middle West. Yields in regions ideal for growing the crop, as in the Willamette Valley of Oregon, may average 8 to 10 tons per acre.

## Cost of Production

Unfortunately no definite costs of production of Jerusalem artichokes under commercial conditions of culture are available. Various estimates have been made, ranging all the way from $40 to $80 per acre. Production costs, except those for harvesting, should not be greatly different from those for potatoes. Thus far spraying has not been practiced, but occasionally serious leaf diseases defoliate the

plants in the late summer. Harvesting costs for artichokes are certain to be higher than for potatoes. The removal of the tops is an additional item, and the tubers are smaller and more widely scattered through the soil. Although there has been insufficient experience to permit an estimate of costs, it seems clear that the crop will not be a very cheap one to grow, harvest, and handle.

## Summary of Cultural Recommendations

(1) Grow only strains known to be high yielding and of acceptable color and shape.

(2) Use only good, sound seed tubers that are free from injury and disease.

(3) Plant as early as the soil can be properly worked in the spring.

(4) Plant seed pieces approximately 2 ounces in weight, preferably whole, but cut if necessary.

(5) Except in unusually favorable regions for the crop, as in the semihumid western part of Oregon, plant in rows 3 feet apart with seed pieces 2 feet apart in the rows. In localities comparable to Corvallis, Oreg., plant in rows 5 to 6 feet apart with seed pieces 3 to 4 feet apart in the rows.

(6) Cover the seed pieces to a depth of 4 inches, except in certain arid regions at high altitudes where the surface soil dries out quickly. Under such conditions plant 5 inches deep.

(7) If the crop is grown for its tubers, leave the tops undisturbed until killed by frost.

(8) Follow artichokes with a late-sown, quick-growing hay crop or cultivated crop. Plow deeply and thoroughly when the volunteer artichokes are a foot or more high. Hand-pull the survivors, unless they will be destroyed before August by harvesting the crop in which they are growing.

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